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| Mathematics Design Collaborative |
| State of Georgia Department of Education |



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| **Coefficient Correlation and Linear Regressions** |
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| ***iRegress!*** |
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| **INTRODUCTION TO THIS FORMATIVE ASSESSMENT LESSON** |

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| **MATHEMATICAL GOALS** |
| This lesson unit is intended to help you assess how well students are able to: |
| * Interpret the correlation coefficient * Interpret the slope and y-intercept of a line of best fit in the context of the data. * Contrast correlation and causation |

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| **GEORGIA STANDARDS OF EXCELLENCE** |
| This lesson involves mathematical content in the standards from across the grades, with emphasis on: |
| **MGSE9-12.S.ID.6a** **Decide which type of function is most appropriate by observing graphed data, charted data, or by analysis of context to generate a viable (rough) function of best fit. Use this function to solve problems in context. Emphasize linear, ~~quadratic~~ and exponential models.**  **MGSE9-12.S.ID.7** Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.  **MGSE9-12.S.ID.8** **Compute (using technology) and interpret the correlation coefficient “r” of a linear fit. (For instance, by looking at a scatterplot, students should be able to tell if the correlation coefficient is positive or negative and give a reasonable estimate of the “r” value.) After calculating the line of best fit using technology, students should be able to describe how strong the goodness of fit of the regression is, using “r”.**  **MGSE9-12.S.ID.9** Distinguish between correlation and causation. |
| * SMP1-Make sense of problems and persevere in solving them. * SMP2-2. Reason abstractly and quantitatively. * SMP3- Construct viable arguments and critique the reasoning of others. * SMP6 - Attend to precision |

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| **INTRODUCTION** |
| This lesson is structured in the following way: |
| Before the Lesson  Students work individually to complete a task that is designed to reveal their current understandings and difficulties. You then review their work, and create some questions that will help them improve their difficulties. |
| At the Start of the Lesson  Students discuss a set of regression outputs in order to provide background for the lesson task. |
| During the Lesson  Students work in pairs or small groups on a collaborative discussion task. They analyze and determine the accuracy of the given interpretations of regression outputs. |
| After the Whole-Group Class Discussion  Students work individually again, on a clean task similar to the original task, allowing them to demonstrate the progress they have made during the lesson. |

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| **MATERIALS REQUIRED** |
| Each individual student will need: |
| * One copy of the assessment tasks: *Is TV Affecting Your Grades?* and *Sleep and Test Grades* * You will need sufficient sets of *Truths* - one for each small group * Large sheets of paper, glue sticks, markers |

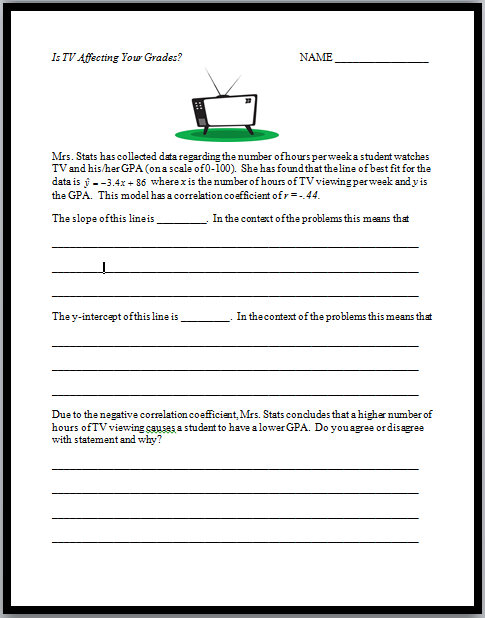
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| **TEACHER PREP REQUIRED** |
| * copies |

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| **TIME NEEDED:** | | | | | | |
| For Pre-Assessment: | 15 min | For Lesson: | 1 hour | For Post: | 15 min |

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| **FRAMING FOR THE TEACHER:** |
| This FAL seeks to discover misconceptions related to linear regression, correlation coefficients, and correlation vs. causation. Students should check first to see if data is somewhat linear (The calculator will generate an “m” and a “b” for them, regardless of the apparent shape. They must be able to determine the appropriateness of the linear correlation process to the data they have in front of them). This lesson is meant to be placed after students have had practice with the linear correlation process. Students should be given the opportunity to defend their television watching, thus contrasting correlation and causation. The discussions spawned from this will be interesting and relevant to them. |

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| **FRAMING FOR THE STUDENTS:** |
| Say to the students: |
| *This activity will take about \_2\_days for us to complete.* |
| *The reason we are doing this is to be sure that you understand: correlation, causation, and linear regression before we move on to a new idea.* |
| *You will have a chance to work with a partner to correct any misconceptions that you may have. After the partner work, you will be able to show me what you have learned!* |

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| **PRE-ASSESSMENT BEFORE THE LESSON** |
| **ASSESSMENT TASK: Is TV affecting your grades?** |
| Time This Should Take: 15 minutes |

Have the students do this task in class or for homework, a day or more before the formative assessment lesson. This will give you an opportunity to assess the work, and to find out the kinds of difficulties students have with it. You will them be able to target your help more effectively in the follow-up lesson.

Give each student a copy of the Pre-Assessment:

Briefly introduce the task and help the class to understand the problem and its context.

*Spend 15 minutes working individually on this task. Read through the task and try to answer it as carefully as you can. Show all your work so that I can understand your reasoning. Don’t worry if you can’t complete everything. There will be a lesson that should help you understand these concepts better. Your goal is to be able to confidently answer questions similar to these by the end of the next lesson.*

Students should do their best to answer these questions, without teacher assistance. It is important that students are allowed to answer the questions on their own so that the results show what students truly do not understand.

Students should not worry too much if they cannot understand or do everything on the pre-assessment, because in the next lesson they will engage in a task which is designed to help them.. Explain to students that by the end of the next lesson, they should expect to be able to answer questions such as these confidently.

This is their goal.

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| **COLLABORATION TIME/READING STUDENTS RESPONSES** | |
| **You Will Not “Grade” These!** | |
| Collect students’ responses to the task. It is helpful to read students’ responses with colleagues who are also analyzing student work. Make notes (on your own paper, not on their pre-assessment) about what their work reveals about their current levels of understanding, and their approaches to the task. You will find that the misconceptions reveal themselves and often take similar paths from one student to another, and even from one teacher to another. Some misconceptions seem to arise very organically in students’ thinking. Pair students in the same classes with other students who have similar misconceptions. This will help you to address the issues in fewer steps, since they’ll be together. (Note: pairs are better than larger groups for FAL’s because both must participate in order to discuss!) | |
| You will begin to construct Socrates-style questions to try and elicit understanding from students. We suggest you write a list of your own questions; however some guiding questions and prompts are also listed below as a jumping-off point. | |
| **GUIDING QUESTIONS** | |
| ***COMMON ISSUES*** | ***SUGGESTED QUESTIONS AND PROMPTS*** |
| **Student has a hard time getting started** | * *What would happen if you plugged numbers in place of x?* * *What would the parent function look like without the plus four, minus one, etc…?* |
| **Student incorrectly identifies the slope or the y-intercept.** | * *y=mx+b is slope-intercept form of the equation of a line; what do m and b represent?* * *In this form of a linear equation, where are the slope and y-intercept found?* |
| **Student incorrectly interprets the slope.** | * *Slope is rise over run (change in y over change in x): how can we apply that to hours of TV viewing and GPA variables?* * *A positive/negative slope would indicate what about the relationship between the x and y variables?* |
| **Student incorrectly interprets the y-intercept.** | * *What is the x-value for a y-intercept?* * *Y variable in this case is GPA, at point where y-intercept would be found, x variable (number of hours of TV) is \_\_\_\_?* * *What does this tell us?* |
| **Student misinterprets correlation as causation.** | * *What does it mean for one thing to cause another to occur?* * *If two variables have a relationship mathematically, does that mean that one causes another to happen in the real-world?* |
| **Student has a hard time getting started** | * *What would happen if you plugged numbers in place of x?* * *What would the parent function look like without the plus four, minus one, etc…?* |
| **Student incorrectly identifies the slope or the y-intercept.** | * *y=mx+b is slope-intercept form of the equation of a line; what do m and b represent?* * *In this form of a linear equation, where are the slope and y-intercept found?* |

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| **LESSON DAY** | |
| **SUGGESTED LESSON OUTLINE:** | |
| **Part 1: Whole-Class Introduction:** | **Time to Allot: ( 10 minutes)** |
| Display the “Warm Up” question provided. (Slide P-1) | |
| This will initiate student thinking about concepts/ideas related to linear regression. Give students time to brainstorm individually, and then come together as a whole class. Use this as a starting point for discussing: sometimes, always, never true. Ask students to identify themselves as: agree, disagree, or unsure. Choose a student from each to share his/her logic in selecting agree, disagree, or unsure. | |
| Suggested Prompts:. | |
| * *What is correlation?* * *What is causation?* * *How are these the same, and how are they different?* * *Does linear regression show that one thing causes another?* * *What must be true in order for linear regression to be the best method?* The data when plotted should appear linear. * *Are there conditions to check?* In addition to a linear pattern, after the line is fit, residuals should be checked to ensure no patterns arise (also part of this unit but we may wish to leave this question out). * *How do we start the process of examining data to fit a line of best fit?* Students should start by graphing the points to check for linearity (this also relates to the discussion about linear regression being the only method). Then they would enter the data into L1 and L2 in their calculator, or into two columns in MS Excel. * *Is this the only method?* Students should be familiar with exponential models in this unit as well, but it may or may not have been covered at this point.  I would also assume some discussion of higher order models when looking at data that is not linear would probably have been done but we know what it means to assume... | |

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| **Part 2: Collaborative Activity: Time to Allot: ( 35 minutes)**  Do/Say the Following: |
| Put students into their pairs according to your analysis of student errors.  Give each group a set of *Truths* along with other necessary materials for compiling their finished product. (Projection resource P-2 can be used here.)   * *You are now going to work in groups (pairs) to explore a set of Truths.* * *There are 11. It is your task to determine which truths are:* Always, Sometimes, Never *true.* * *Within your group, align each statement with its corresponding level of truth.* * *As you are working, be sure to clearly communicate your reasoning with your group (partner). It may help to have another member of your group record the logic that led to your decision on a scratch sheet of paper or post-it.* * *Be sure to leave plenty of space around each statement when gluing them to the paper.* * *For each statement that is* Never or Sometimes true*, revise its wording to reflect something that is always true. This may take only one or two words difference or it may need a complete overhaul. Record your edits on your paper. If you are not able to do this, provide an example showing why it is not always true instead.* |
| During the Collaborative Activity, the Teacher has 3 tasks:   * Circulate to students’ whose errors you noted from the pre-assessment and support their reasoning with your guiding questions. * Circulate to other students also to support their reason in the same way. * Make a note of student approaches for the summary (plenary discussion). Some students have interesting and novel solutions! |
| **Part 3: Plenary (Summary) Discussion: Time to Allot: ( 15 minutes)**  Gather students together, share solutions. Discussion prompts should be made up of your original guiding questions and notes about student approaches. Some other discussion prompts are listed below:  NOTE: *“Scribing” helps to increase student buy-in and participation. When a student answers your question, write the student’s name on the board and scribe his/her response quickly. You will find that students volunteer more often when they know you will scribe their responses – this practice will keep the discussions lively and active!* |
| Share the solutions as to Always, Sometimes, Never true. Ask students which *Truths* were the most difficult or easiest to classify or those that they are still unsure about. Have students share revisions/examples for the Never or Sometimes true statements. Encourage students to add in real-world examples, if possible.  Alternate Discussion Prompt:  In order to ensure understanding of each *truth*, you may wish to use the following example, P-3 (or one of your own making) to guide discussion. For example, in examining the statement *The correlation coefficient, r, indicates the percentage of points that fall on the regression line,* you may choose to discuss that 87.4% of points are not on the line of best fit.  You may wish to use this example to further discuss finding and interpreting the slope of the regression line as well:   * *What does x represent?[Thousands of miles driven]* * *What does -86 represent mathematically (slope or y-intercept)?* * *What does -86 represent in the context of the problem?[Slope; for each increase of the number of miles by 1000 (x increases by 1), the value of the vehicle decreases by $86.18]* * *What does $18773 represent mathematically? What does it represent in the context of the problem?[The y-intercept represents the value of a Honda CRV with no miles]* |
| **Part 4: Improving Solutions to the Assessment Task Time to Allot: ( 15 minutes)**  The Shell MAP Centre advises handing students their original assessment tasks back to guide their responses to their new Post-Assessment (which is sometimes the exact same as the Pre-Assessment). In practice, some teachers find that students mindlessly transfer incorrect answers from their Pre- to their Post-Assessment, assuming that no “X” mark means that it must have been right. . Until students become accustomed to UNGRADED FORMATIVE assessments, they may naturally do this. Teachers often report success by handing students a list of the guiding questions to keep in mind while they improve their solutions.  Practice will make perfect, and teachers should do what makes them most comfortable with their students’ misconceptions. |

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| **PRE-ASSESSMENT (Answer Key)** |
| **ASSESSMENT TASK: *Is TV Affecting Your Grades?*** |
| *Is TV Affecting Your Grades?* NAME \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Description: MC900438705[1]  Mrs. Stats has collected data regarding the number of hours per week a student watches TV and his/her GPA (on a scale of 0-100). She has found that the line of best fit for the data is  where *x* is the number of hours of TV viewing per week and *y* is the GPA. This model has a correlation coefficient of *r = -.44.*  The slope of this line is \_\_\_***-3.4***\_\_\_\_\_\_. In the context of the problems this means that  ***Interpretation: For each increase in x (number of hours of TV), there is a decrease in y(GPA out of 100) of 3.4 points.***  The y-intercept of this line is \_\_86\_\_\_\_\_\_\_. In the context of the problems this means that  ***Interpretation: For an individual who watches no TV, it is predicted that he/she will have a GPA of 86 (out of 100 points).***  Due to the negative correlation coefficient, Mrs. Stats concludes that a higher number of hours of TV viewing causes a student to have a lower GPA. Do you agree or disagree with statement and why?  ***Correlation does not imply causation. Students could bring to light that we do not know what other variables may be at work here or that we do not know how data is collected in order to decide whether a controlled experiment was completed to suggest causation*** |

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| **Collaborative Activity (Answer Key)** |
| **Solutions: Lesson Task: Classifying Truths**  **SOMETIMES:**  **A correlation coefficient that is negative indicates a weak correlation**. *Sign has no bearing on the strength of correlation, proximity to -1 or 1 indicates strength. It is possible that a negative r value corresponds to a weak correlation but this is not always the case. Reworded: A negative correlation indicates a decreasing trend.*  **A correlation coefficient that is positive indicates a strong correlation.** *Sign has no bearing on the strength of correlation, proximity to -1 or 1 indicates strength. It is possible that a positive r value corresponds to a strong correlation but this is not always the case. Reworded: A positive correlation indicates an increasing trend.*  **The slope of the line of best fit equals *r*.** *In some cases, the slope and r may coincidentally be the same but this is not typical. Reworded: r equals the strength of the correlation between x and y or the slope tells how much y changes as x changes, etc.*  **The predictions made from a regression model are accurate.** *There are many factors to consider here. Predictions made outside the range of the domain of data collected (extrapolations) are susceptible to error. Also, often there are real-life values that appear to fall outside the scope of the model (examine the pre-assessment, how would a student earn a 100 GPA? Watch negative amounts of TV?)*  **NEVER:**  **The stronger the correlation, the more likely that *x* causes *y***. *Correlation does not imply causation. Correlation is the mathematical measure of the linear relationship and not a representation of any real-world relationship that may or may not exist.*    **The correlation coefficient, *r,* indicates the percentage of points that fall on the regression line.** *The correlation coefficient measures the strength of the relationship and a strong relationship may exist though few, or no, points may fall precisely on the line of best fit. (One may argue that in very rare cases, like when r = 1, it could be argued that 100% of the points fall on the regression line thus making this statement true "sometimes" )*  **A large positive slope shows that the increase in *y* is caused by the increase in *x*.** *Slope only indicates the change in the dependent variable with a one unit change in the independent variable, it does not imply causation in any form. This is easily reworded to: A large positive slope shows that for a change of 1 in x, there is a large increase in y.*  **A large negative slope shows that the decrease in *y* is caused by the increase in *x.*** *Slope only indicates the change in the dependent variable with a one unit change in the independent variable, it does not imply causation in any form. This is easily reworded to: A large negative slope shows that for a change of 1 in x, there is a large decrease in y.*  **ALWAYS:**  **The correlation coefficient is between -1 and 1, inclusive.**  **The *r* value indicates the sign of the slope.**  **The slope of the line of best fit gives the change in the dependent variable with respect to a one unit change in the independent variable.**  **The *y*-intercept gives the point where the *x*-variable is zero.** |
| **POST-ASSESSMENT (Answer Key)** |
| **ASSESSMENT TASK: *Sleep and Test Grades?*** |
| *Sleep and Test Grades* NAME \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  C:\Users\mollie.jones\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\E1Y1YKU2\MC900358879[1].wmf  Mr. Regs has collected data regarding the number of hours of sleep his students go the night before a big test and their test score (0-100\_. He has found that the line of best fir for the data is  where *x* is the number of hours of sleep and *y* is the test score. This model has a correlation coefficient of *r = .44.*  The slope of this line is \_\_\_***4.5***\_\_\_\_\_\_. In the context of the problems this means that  ***Interpretation: For each increase in x (number of hours of sleep), there is an increase in y(test score out of 100) of 4.5 points.***  The y-intercept of this line is \_\_\_\_\_***72\_\_\_\_.*** In the context of the problems this means that  ***Interpretation: For an individual who does not sleep, it is predicted that he/she will have a test score of 72(out of 100 points).***  Due to the positive correlation coefficient, Mr. Regs concludes that a higher number of hours of sleep viewing causes a student to have a higher test score. Do you agree or disagree with statement and why?  ***Correlation does not imply causation. Students could bring to light that we do not know what other variables may be at work here or that we do not know how data is collected in order to decide whether a controlled experiment was completed to suggest causation*** |

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| **PRE-ASSESSMENT** |
| *Description: MC900438705[1]Is TV Affecting Your Grades?* NAME \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Mrs. Stats has collected data regarding the number of hours per week a student watches TV and his/her GPA (on a scale of 0-100). She has found that the line of best fit for the data is  where *x* is the number of hours of TV viewing per week and *y* is the GPA. This model has a correlation coefficient of *r = -.44.*  The slope of this line is \_\_\_\_\_\_\_\_\_. In the context of the problems this means that  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_    \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  The y-intercept of this line is \_\_\_\_\_\_\_\_\_. In the context of the problems this means that  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_    \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Due to the negative correlation coefficient, Mrs. Stats concludes that a higher number of hours of TV viewing causes a student to have a lower GPA. Do you agree or disagree with statement and why?  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_    \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |

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| **COLLABORATIVE ACTIVITY** |
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| **POST-ASSESSMENT** |
| **ASSESSMENT TASK: *Sleep and Test Grades?*** |
| *Sleep and Test Grades* NAME \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  C:\Users\mollie.jones\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\E1Y1YKU2\MC900358879[1].wmf  Mr. Regs has collected data regarding the number of hours of sleep his students go the night before a big test and their test score (0-100\_. He has found that the line of best fir for the data is  where *x* is the number of hours of sleep and *y* is the test score. This model has a correlation coefficient of *r = .44.*  The slope of this line is \_\_\_\_\_\_\_\_\_\_\_. In the context of the problems this means that  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_    \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  The y-intercept of this line is \_\_\_\_\_\_\_***\_\_\_\_.*** In the context of the problems this means that  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_    \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Due to the positive correlation coefficient, Mr. Regs concludes that a higher number of hours of sleep viewing causes a student to have a higher test score. Do you agree or disagree with statement and why?  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_    \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |

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| **Lesson Day Warm-Up** |
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| **Collaborative Activity Instructions:** |
| **Collaborative Activity Instructions:**   1. **You have been grouped in pairs** 2. **You have been given a set of cards** 3. **On those cards are 11 “truths”. It is your task to determine if they are true ALWAYS, SOMETIMES, or NEVER.** 4. **Within your group, align each statement with its corresponding level of truth.** 5. **As you are working, be sure to clearly communicate your reasoning with your group (partner). It may help to have another member of your group record the logic that led to your decision on a scratch sheet of paper or post-it.** 6. **Be sure to leave plenty of space around each statement when gluing them to the paper.** 7. **For each statement that is Never or Sometimes true, revise its wording to reflect something that is always true. This may take only one or two words difference or it may need a complete overhaul.** 8. **Record your edits on your paper. If you are not able to do this, provide an example showing why it is not always true instead.** |

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| **Collaborative Plenary Discussion Questions:** |
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